Reclamation Of Strip-Mined Lands in Vigo County, Indiana

LEE GUERNSEY, Indiana State Teachers College

Geographical and geological conditions have favored strip coal mining in Southwestern Indiana. The coal seams commonly lie below undulating to rolling plains, which permit the use of large machinery and aid in the installation of preparation plants and transportation routes at optimum locations. Several nearly horizontal seams of coal lie at relatively shallow depths and generally vary from three to eight feet in thickness. Most of the overburden consists of relatively soft, easy-to-handle clays, limestones, and shales. These conditions have enabled strip mining companies to produce most of Indiana's coal in recent years.

Within Southwestern Indiana about 70,000 acres of land have been strip mined for coal (Fig. 1). The greatest area of strip mining is in Pike and Warrick Counties where more than 25,000 acres of land have been stripped. Approximately 4,500 acres of land have been strip mined for coal in Vigo County, and 900 additional acres have been covered with spoil. Most of the strip mining in Vigo County has taken place around the Riley-Blackhawk area in Riley and Pierson Townships. Large reserves of Indiana No. V coal are in this area. The overburden averages about 65 feet in depth but varies from 40 to 90 feet, and is generally relatively easy to handle.[1] It commonly consists of about 10 feet of hard shale on top of the coal, followed by 6 feet of hard limestone, 7 feet of shale, 3 feet of limestone, 34 feet of gravelly clay, and 5 feet of clay, silt, and soil (Fig. 2).

Most of the remainder of the strip mining in Vigo County has taken place south of Seelyville in Lost Creek Township, southeast of Pimento in Linton Township, and in the northeastern corner of the county around Fontanet in Nevins Township (Fig. 3).

About five per cent of the agricultural land of the county, which is medium grade agricultural land, has been strip mined. Since most of the stripped area was under tillage prior to stripping, the physical landscapes have been markedly altered. Strip-mining operations generally take place throughout several contiguous sections, and so strip mining leaves the surface of large contiguous areas worked in a series of rough ridges and valleys (Fig. 4). The steep slopes of the typical saw-tooth profile of stripped areas causes the loose materials on the ridges to erode rapidly. The severity of erosion varies with the physical composition of the spoil material, the degree of slope, and the density and character of the vegetation. But the general rapid rate of eroding the spoil banks constitutes a principal reclamation problem.

Another detrimental effect of strip mining, in addition to erosion and removing the land from agricultural tillage, is that of unsightliness. The spoil banks of newly overturned earth give a desolate appearance to the landscape. The spoil banks, if left without vegetation, stand as an unsightly blot on the landscape. Natural vegetation will come

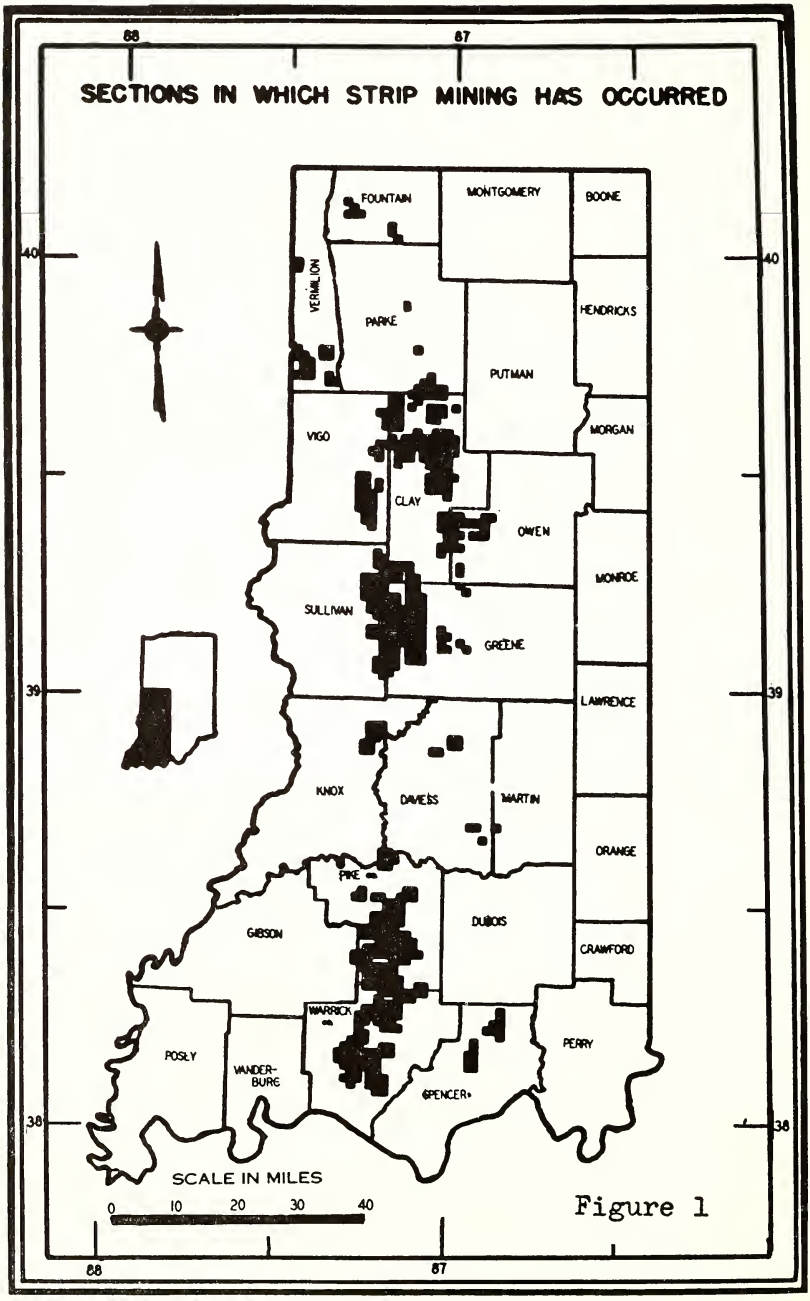
SECTIONS IN WHICH STRIP MINING HAS OCCURRED
88
87
40
39
38
FOUNTAIN
MONTGOMERY
BOONE
VERMILION
PARKE
HENDRICKS
PUTMAN
MORGAN
VIGO
CLAY
OWEN
MONROE
SULLIVAN
GREENE
LAWRENCE
KNOX
DAVIESS
MARTIN
ORANGE
PIKE
GIBSON
DUBOIS
CRAWFORD
WARRICK
POSEY
VANDER-
BURG
SPENCER
PERRY
SCALE IN MILES
0 10 20 30 40

Figure 1

up in some areas, but most will remain barren for some time. Natural reforestation is very slow on most spoil banks. It normally produces an inadequate, or barely adequate, tree cover for the first couple of decades. Not only is natural reforestation very slow, but the trees or grasses which grow on spoil banks are practically all of the less

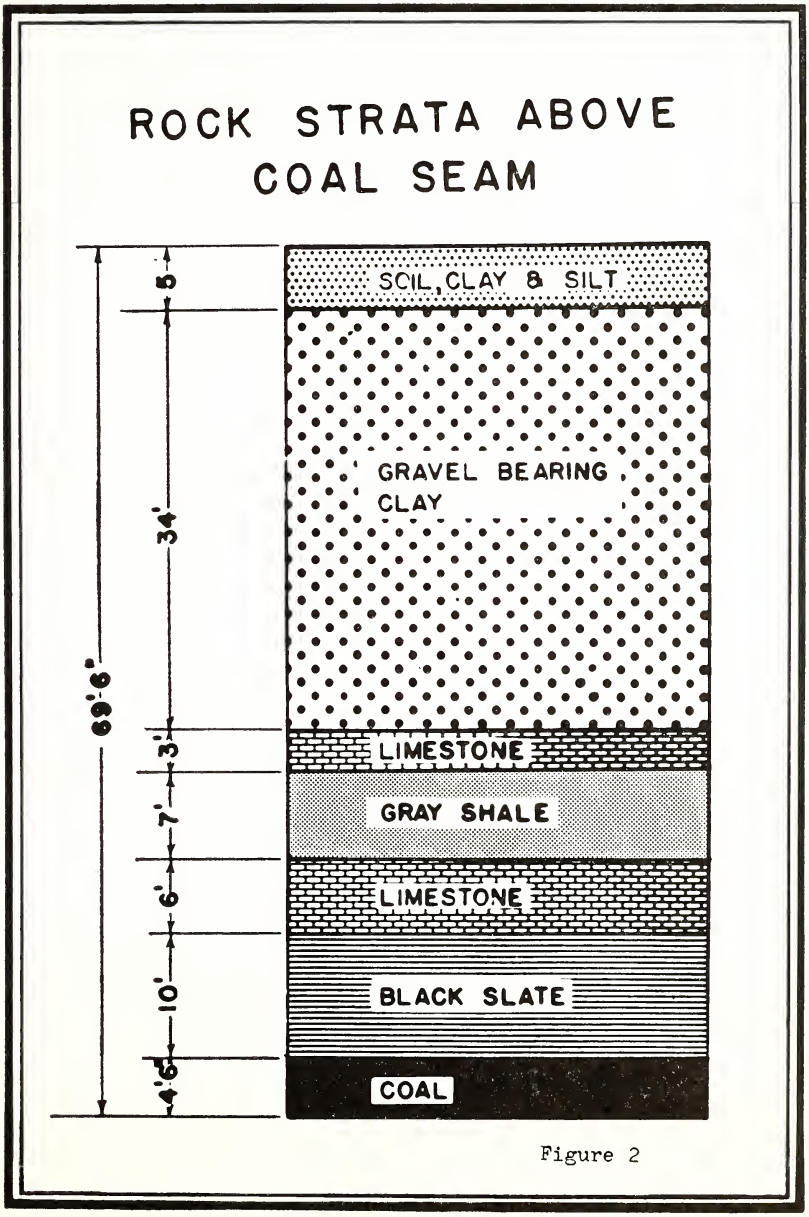

Figure 2

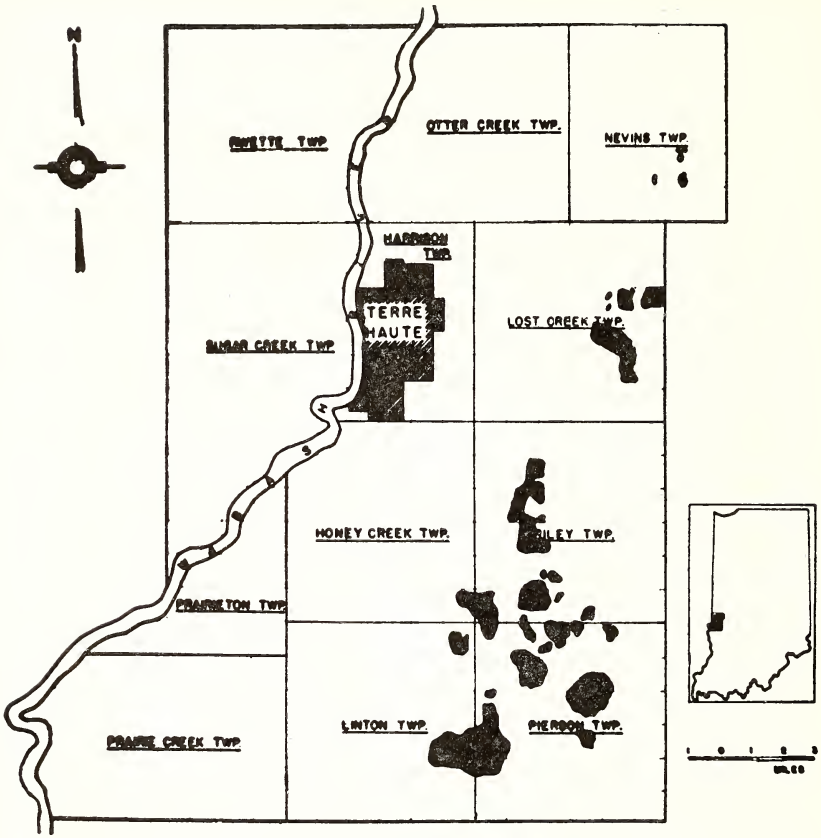

Figure 3

valuable species. In cases where a heavy volunteer stand of timber does develop on strip-mined land, the trees are generally short-boled, limby, and contain few high-grade products. Except during periods of unusually heavy demand, these trees probably could not be marketed as saw timber.[2]

In addition to the slow growth, undesirable quality and poor species, the natural tree stand has the further handicap of being poorly distributed over the spoil banks. The most valuable tree species are normally confined to the outer portions of the stripped areas. Saw-timber and pole trees generally occur only in scatter clumps. Most of the openings between trees are covered with weeds, grasses, briars and shrubs. The better timber species find it difficult to invade this type of ground cover.

The most important function served by the natural vegetation, since the trees are of little or no commercial value, is in providing a site for

more valuable species. In this respect, the natural vegetation provides a good index of the ability of the spoil banks to support vegetation. However, the spoil banks have been wasted of their potential production

Figure 4

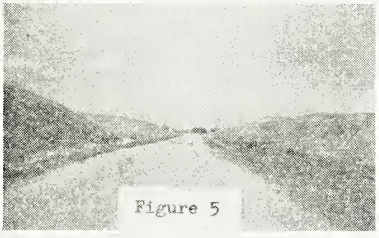

Figure 5

Figure 6

Figure 7

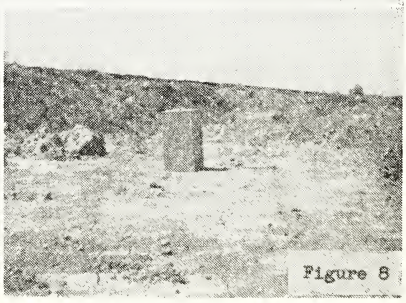

Figure 8

during this time. While reliance on nature to provide a good tree stand requires the patience of Job, spoil banks planted in trees can produce marketable trees within a reasonable period of time.

During the 1930's under the impetus of the Indiana Coal Producers Association, a few hundred acres of spoil banks were voluntarily planted in trees in Vigo County. Since 1941, when the State Legislature first passed a law drafted by the State, the Farm Bureau, and the coal industry), all the strip-coal operators are required to revegetate all the acreage disturbed. In addition, the present Indiana law states that "the operator shall work any unsightly ridges remaining in the operation by striking off the same to a width of at least 8 feet at the top. Any unsightly, isolated peaks shall be graded at the top to a minimum of 15 feet. Grading shall be carried on to reduce unsightly peaks and ridges to a rolling topography immediately adjacent to public highways."[3] The act of 1951 further states that "On all areas seeded to pasture, said operators shall strike off peaks and fill valleys in such a manner that the area can be transversed with farm machinery" (Figs. 5 and 6).

Grading of Spoil Banks

Whether or not spoil banks should be graded is a controversial issue. A casual consideration of the question may lead observers to quickly conclude that grading would reclaim the land and fit it for profitable crop land. On the other hand, strip-mining companies are quick to point out a high cost of grading spoil banks and they also add that the absence of topsoil still results in low productivity and reduced land values.

Most strip-mine operators oppose grading of spoil banks. They generally state that grading causes excessive compaction which, in turn, causes poor aeration and low percolation rates. These adverse conditions are usually said to be due to the weight of grading machinery and from the weight of the materials which were located above the newly formed surface before grading.

An analysis of the compaction of spoil material by the writer indicated the contrary. Numerous compaction tests showed that graded spoil banks have a lower compaction than surrounding unmined lands (Figs. 7 and 8). The average of all graded spoil banks tested was 86.4 per cent as dense as natural soil density. This is true despite the fact that many density tests were taken in places which had been unusually compacted by numerous trips of the tractor-crawler tracks. Thus, it appears to the writer that graded spoil banks are loose and friable enough to support any vegetation that grows on adjacent unmined land.

Variations in compaction ranged from 68.6 to 92.5 per cent as dense as unmined land. The amount of compaction apparently depended mainly upon the length of time between the strip mining and grading processes, the method of performing the grading process, the texture of the spoil, and the moisture content at the time of grading. The least compact area had a short interval between strip mining and grading, had the dragline scatter the material, and graded coarse-textured spoil with a crawler tractor when it was dry.

No doubt, grading is generally desirable. It makes the strip-mined lands more accessible, and it reduces the unsightliness. Grading especially improves the appearance of the landscape during the first years

after strip mining and during the winter when the foliage is absent. It makes spoil banks accessible for pastures and is also essential for efficient tree plantings and logging operations.

The amount of grading done is usually determined by how rugged or unsightly the mined area appears and the future land use of the spoil banks. For example, if the spoil banks are adjacent to a public road, they are often graded down to a rolling topography. The further the spoil banks are from the road, the less the amount of grading normally done. Likewise, the amount of grading done also depends upon the general cross section of the spoil banks. For example, the higher and more peaked the spoil, the more grading required. Finally, the ultimate use of the stripped land is a deciding factor in the amount of grading required.

Reforesting Spoil Banks

Tree planting has been the most popular method of revegetating spoil banks. Original planting costs are usually low, the planted trees grow rapidly, hide spoil banks quickly, and provide an attractive cover. In a few years, plantings reduce bank erosion and provide a good setting for recreational areas. Finally, these planted spoil banks grow forest crops with several plantings on strip-mined lands growing more rapidly than the same species planted on unmined lands.

Originally many different species were planted. It was not known which trees would survive, which would grow fastest, how close to plant them, when to plant them, and how to plant them. Past failures and successes, together with knowledge gained from research, now give us suggestions for successful tree plantings.

Some of the earliest plantings have reached the point where they can produce such forest products as fence posts, mine props, poles, and Christmas trees in Vigo County. The earliest plantings of deciduous species were limited mainly to pure stands of black locust. Many were so badly riddled with black locust borers that the tree is no longer planted in pure plantations. However, when locust trees are mixed with other hardwoods, they seem to have found their rightful place. Among the trees with which locust has grown well in Vigo County, Indiana, are red oak, black walnut, and tuliptree (Fig. 9).

Some experiments have been conducted on direct seeding instead of planting trees. They have generally shown poor and erratic results which indicates that planting of tree seedlings is more practical for general use than direct seeding. Insects, pests, diseases, and hot, dry weather in early summer all are more likely to cause failures in direct seeding than in planting trees. Planting is more likely to give satisfactory results over a number of years which include both good and poor planting seasons.[4]

Revegetating with Grasses

Grasses also yield good returns in certain spoil banks, but the chances of failure are greater than by planting trees. Mixtures of legumes and grasses are generally considered best because of better erosion control, thicker growths and better seasonal distribution. After

Figure 9

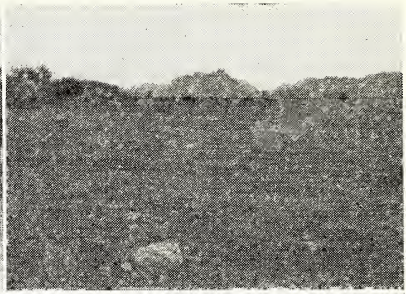

Figure 10

Figure 11

Figure 13

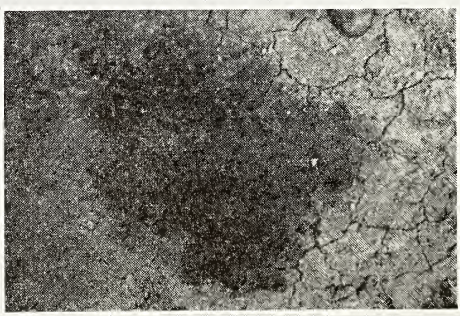

Figure 12

two or three years, certain calcareous spoil banks which have been properly graded and sowed with grasses and legumes can be used as pasture (Figs. 10 and 11). The impounded water supply usually provides plenty of water for livestock.

Some limitations of seeding large areas of spoil banks in pasture are that: (1) spoil banks frequently contain large rocks and boulders so that pasture improvement and maintenance are impractical; (2) pas-

turing capacity fluctuates widely from year to year; and (3) large areas are acid or toxic which prevents the establishment of grasses and legumes (Fig. 12).

Recreational Uses

The reclamation of spoil banks for forestry and pasture do not exhaust the land-use possibilities. A program for developing strip-mined lands into recreational areas has many promising possibilities of success. Lakes formed as water collects among the spoil banks serve as vacation spots with excellent fishing and hunting. In planning the use of these lands for picnicking, bathing, and fishing, one of the first considerations is the creation of impounded water for these purposes.

Several landowners of spoil banks have stocked their strip-mine lakes with fish. The success of their ventures depends upon: (1) the circulation of water, (2) completely covering the coal seam with water to prevent oxidation of sulphur, (3) enough vegetation growing in the water to sustain forms of aquatic life and fish food, and (4) keeping the lake floor clean of mine wastes.

Fishing affords a good potential source of income to most owners of lakes in Vigo County. For example, if one completely ignores the recreational value of fishing (and who can do that), each acre of strip-mined lakes would have a valuable resource of fish. Fish and wildlife experts state that each acre of water should produce 250 pounds of fish each year. Thus, at 250 pounds per year, strip-mine lakes within Vigo County are capable of producing many thousands of pounds of fish annually. This, of course, is in addition to benefits to the health, recreation, and revenue from fishing licenses which are incalculable. In addition, the income from the tourists and sportsmen to business concerns of strip mining areas would be another significant asset if and when strip-mine lakes are commercially developed.

Home Sites

Sections in which strip coal mining has occurred contain more non-farm settlements than other sections within the rural areas of Vigo County. Isolated non-farm settlements have increased strikingly within the strip-mined areas of Vigo County since World War II. Strip mining does not leave a continuous spoil bank that blocks off several contiguous sections. Rather, if a public road is mined out, the coal company builds a new road to replace it. Normally, the new road is a better one than the original road, and the strip-mining company then often reconstructs the original road after strip-mining operations are completed. Thus, more high-quality roads are available for use within the areas strip mined, and strip mining areas are more accessible due to a better road system. Home builders are attracted to building sites which are generally situated on unmined portions, or leveled areas near strip-mine likes (Fig. 13).

Summary

Strip coal mining modifies the landscape by developing a ridge-like terrain, burying topsoil, forming lakes, and destroying the vegetation.

In Indiana, strip coal mining companies are legally required to grade and revegetate the strip-mined land. In Vigo County, topping of the ridges to about eight feet wide is the most widely employed procedure for grading spoil banks which will be planted in trees. More complete leveling is done where areas are to be sowed in grasses or used as home sites. Compaction tests conducted by the writer indicate that compaction of spoil banks due to grading has been greatly exaggerated in most published material on the subject.

Most of the spoil banks in Vigo County are suited for trees. Forest plantings play an important role in reclamation because they help control erosion, improve the "spoil profile", conserve water, and provide recreational facilities. By the use of mixed pines and hardwoods, high-quality forests can be produced on spoil banks. Reforestation is slow, however. More intensive land uses can be accomplished by more complete grading and sowing calcareous spoil banks in grasses and legumes. In addition, the construction of earth dams in the last open cut can provide lakes for recreational areas or building sites which are often more valuable than the surrounding unmined farmland.

Literature Cited

1. YOUNG, W. H. and R. L. ANDERSON. 1952. "Thickness of bituminous coal and lignite seams and thickness of overburden at strip mines in the United States." U. S. Bureau of Mines, Circular 7642.
2. LIMSTROM, G. A. 1948. "Extent, character and forestation possibilities of land stripped for coal in the central states." Central States Forest Experiment Station Technical Paper 109.
3. Chapter 68 of the Acts of 1941 as Amended by Senate Bill 152 as passed by both Houses in 1951. Signed by the Governor, March 3, 1951.
4. DEITSCHMAN, GLENN H. and LANE, RICHARD D. 1952. "Forest planting possibilities on Indiana coal-stripped lands." Central States Forest Experiment Station Technical Paper 131.